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CLASSIFICATION OF MONILIAS ON THE BASIS OF MORPHOLOGY

By C. VIRGINIA FISHER, Ph.D.

Department of Bacteriology and Preventive Medicine, University of Illinois, College of Medicine, Chicago

The classification of the genus Monilia is complicated not by any inherent mycological difficulties, but by the existing confusion in terminology. From the standpoint of botanical terminology, the name "Monilia" probably should not be applied to the human pathogens as a group of saprophytic fungi are known by that name. However, usage has made the name "Monilia" familiar to medical mycologists and clinicians, so its use is advised until such time as a more complete understanding of this group of organisms can be obtained.

The primary isolation of a Monilia is accomplished by spreading suspected material—pus, skin or nail scrapings, or other materials—over the surface of a suitable medium. Suitable media must have the following requisites—sugar, available nitrogen, and a pH on the acid side. There are many varieties in use but the one proposed by Benham (1931) has proven successful: 6 per cent commercial strained honey, 1 per cent bacto-peptone, 2 per cent agar, adjusted to a pH of 5.4, becoming 5.2 after autoclaving. The acidity of the medium helps to reduce the amount of bacterial contamination.

* This is an abstract of a paper given before the Illinois Society of Clinical Laboratory Technicians and the Society of Illinois Bacteriologists.

Monilia colonies attain a convenient size in 24 to 48 hours. Smears stained with methylene blue or Gram stain or wet cover-slip preparations are then examined for the presence of budding forms. (Practically all yeasts and fungi are Gram positive.) Colonies of these may then be picked and kept on honey slants for further study.

The presence of budding forms merely indicates the presence of a yeast or yeast-like organism. Further study is necessary to determine whether a Monilia or some other yeast-like fungus is present.

Monilias may be differentiated from the rest of these by the fact that while they all reproduce by budding, the Monilias never produce ascospores, and under proper circumstances produce mycelia.

Morphologic characteristics of most yeasts and fungi show best on a non-nutrient medium such as Benham's cornmeal agar. This medium promotes production of mycelia, ascospores, and other diagnostic morphologic characteristics. The cornmeal agar plates are poured thick and inoculated by making three or four deep streaks across the plate. The mycelia appear growing out from the stab at various depths in the medium. They can be studied in situ or in NaOH mounts in both instances. The low powers of the microscope are used in the study. The NaOH mounts are made by placing a piece of the agar containing the mycelial growth on a slide with a drop of NaOH and flattening with a cover-slip. This latter method has the advantage that higher magnification can be used, and the details of the mycelial structures more carefully studied. The plates are kept from 10 to 12 days and observed daily for any changes.

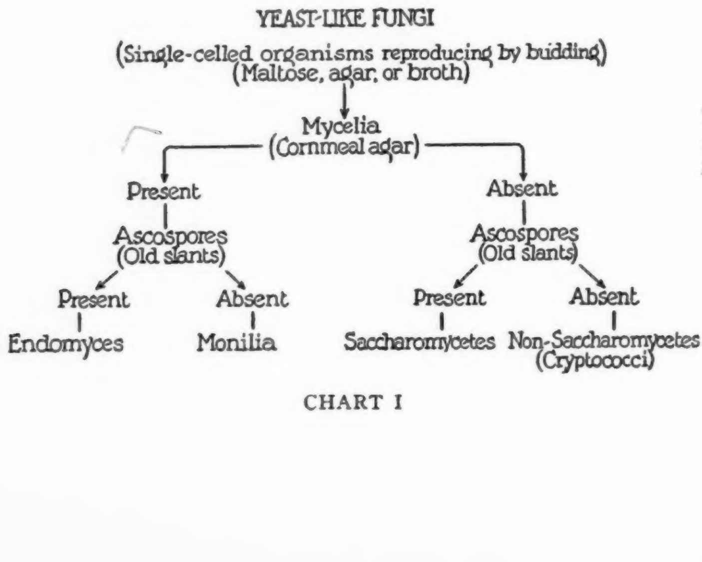

CHART I

Giant colonies, made by inoculating a honey agar plate in the center and allowing to grow for a period of three to four weeks, are an aid in diagnosis providing the media and cultural conditions are kept constant.

The size and shape of budding cells is best studied in 24 hour honey broth cultures as there is less distortion of the cells and the presence or absence of the formation of a top scum in broth can also be observed.

Description

In the Monilia group are placed all those forms producing mycelia but no ascospores. A study of the mycelia is of great importance in placing the organisms belonging to this genus into the correct species.

Monilia albicans: The mycelia of M. albicans are usually diagnostic within 48 hours on cornmeal agar. There are numerous large terminal chlamydospores, which are thick-walled and seem to contain fat globules. Frequently a few buds are formed at the septum of the mycelium; these reproduce to form large clusters, and in old cultures may completely obscure the mycelium. Both types of hyphae are found in cultures of M. albicans, but usually there is a preponderance of one or the other. The giant colonies are creamy white, with smooth centers, and heavily branched filaments around the edges. They are seldom heaped up in the center. They usually attain a size of from 3 to 4 centimeters in four weeks. The budding cells from a broth culture are quite round, varying in size, and irregularly stained with methylene blue. An inverted pine-tree is produced in gelatin. M. albicans quite constantly produces acid and gas in maltose and acid only in saccharose; it also coagulates milk regularly, usually within three days.

Monilia candida: This species also produces a typical mycelial structure which is readily recognized. The mycelium is a heavy, thick-branched type, having definite septa and alternate swellings and strictures giving it a wave-like appearance, with buds placed at irregular intervals along the filament, the buds never multiplying to such an extent as to obscure the mycelial structure. The giant colonies are creamy-white, with a heaped up, rugose center, becoming honey-combed and with smooth edges, sometimes faintly lobulated. The young budding cells in a broth culture are more irregular in shape than M. albicans varying from round to elliptical forms, which stain irregularly with methylene blue. The growth in gelatin resembles an inverted pine-tree in shape. Maltose and saccharose are both fermented with the production of acid and gas; milk is never coagulated.

Monilia parapsilosis: The mycelia of M. parapsilosis are of two types: (1) the young mycelium thinner than M. albicans with no definite septa, the buds at the septa sometimes elongated to form branches, sometimes reproducing as small whorls of buds; and (2) the old mycelial structure, about twice as thick as the former. This heavier type has definite septa at irregular intervals and is usually irregular in configuration at its terminus. The giant colonies are white and are sometimes heaped up and wrinkled in the center. The budding cells are irregular, varying from oval to elliptical, and smaller than the previously described Monilias. A fine fuzz appears along the stab in gelatin, never causing liquefaction. Maltose and saccharose are not fermented and milk is not coagulated.

Monilia krusei: This species has a branched mycelium with elongated buds at the septum, frequently with secondary buds at the distal end. In old cultures the buds may produce irregular whorls at the septa, but they never attain the cluster formation typical of M. albicans; nor are the giant mycelia in M. candida and M. parapsilosis found. The giant colonies are very flat, tan in color, and very irregular in outline, lobulated, resembling pseudopodia from the ends of which filaments occasionally arise; there are concentric bands around the center; the surface is granular. The budding cells are much longer than any other Monilia, being regularly two or three times as long as wide. In broth M. krusei produces a thin wrinkled scum which has led some observers to classify it as a Mycoderma. This organism has very little fermenting power.

Discussion

These four species of Monilia above described represent practically all the species of the genus Monilia. Occasional species will be encountered which do not fit in any of these species but they are rare.

From the clinical standpoint, the only important member of the group is M. albicans. This organism may be found in the literature referred to as Oidium albicans, Saccharomyces albicans, Endomyces albicans, M. psilosis, M. metalondinensis, M. pinoyi, M. butanensis, M. tropicalis and possibly others. It is known to be the etiologic factor in thrush of the mouth, thrush of the vagina, perlèche, paronychia, erosio interligitalis, generalized moniliasis of the skin and occasionally onychomycosis and bronchomycosis. It can be said that the finding of M. albicans on the skin or nails is of diagnostic significance. Its presence in cultures from the oral cavity, sputum,

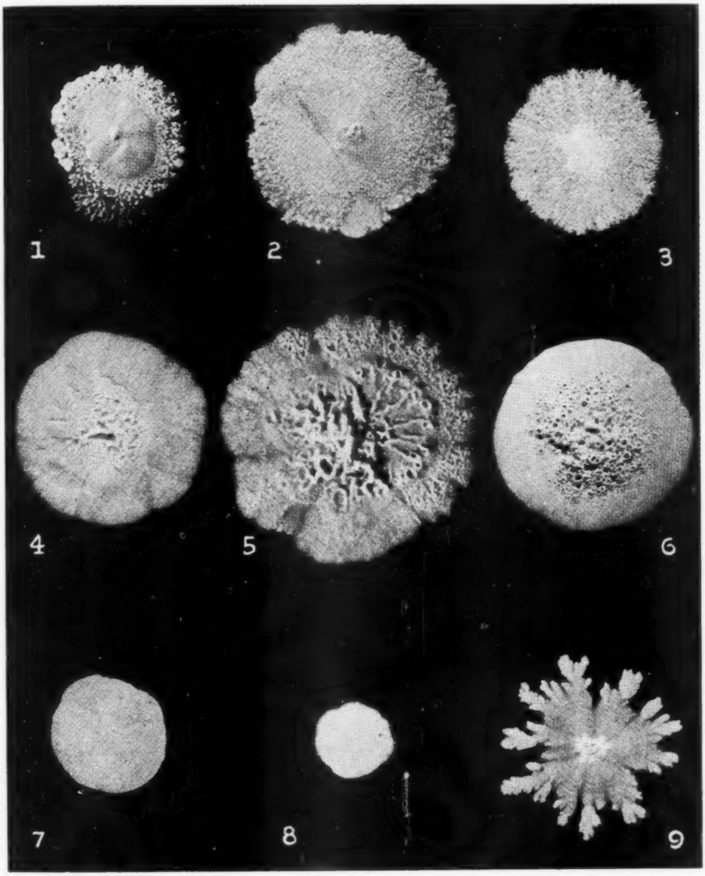

PLATE I

GIANT COLONIES

1, 2, 3. Monilia albicans
4, 5, 6. Monilia candida
7, 8. Monilia parapsilosis
9. Monilia krusei

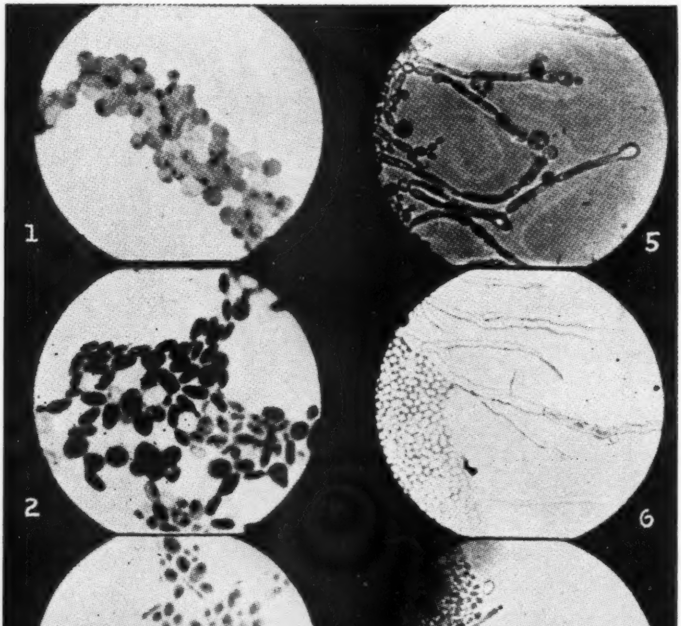

PLATE II

Budding Forms	Mycelia
1. Monilia albicans	1. Monilia albicans
2. Monilia candida	2. Monilia candida
3. Monilia parapsilosis	3. Monilia parapsilosis
4. Monilia krusei	4. Monilia krusei

PLATE III

Mycelia

1 & 2. Monilia albicans—(a) mycelia, (b) chlamydospores, (c) spore clusters.
3. Monilia candida
4. Monilia krusei
5. Monilia parapsilosis, young mycelia
6. Monilia parapsilosis, old mycelia

vaginal discharge, gastric contents, or other sources must be evaluated by the clinician as well as the technician since it appears in normal individuals or as secondary invaders.

None of the other Monilias have been proven pathogenic for man. There is a possibility that M. candida may be occasionally, as it is pathogenic for laboratory animals (to a less degree than M. albicans to be sure) and is serologically difficult to differentiate from M. albicans.

Summary

1. The methods used for isolation and morphologic diagnosis of a Monilia species are discussed.

2. Detailed morphologic descriptions of the four Monilia species are given.

3. The clinical significance of M. albicans is mentioned.

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AS THE STAFF REGARDS THE MEDICAL TECHNOLOGIST

By JOHN R. HARGER, S.B., M.D., F.A.C.S.

Attending Surgeon, Cook County Hospital, Illinois Masonic Hospital, Garfield Park Hospital, Chicago, Ill.

The modern conception of a clinical laboratory is not complete without a brief review of the situation of thirty years ago. If one cares to go further into the evolution of this accessory branch of modern scientific medical practice, he will find that our immediate forebears knew nothing about laboratory procedures, as we know them today, except simple urinanalysis and that was considered a non-essential in many cases.

Less than three score years ago, that much criticized, but necessary evil among the hospital personnel, "the Junior Interne," was the specialist par excellence in all hospital procedures. He was expected to write intelligent histories and record reliable physical findings, give anesthetics, dress all infected wounds and then, after dinner at night or before breakfast, do all routine laboratory work. His findings were supposed to be thoroughly dependable and thus he was rarely asked to repeat his operations for the accuracy of his results were not questioned.

That things have changed is common knowledge. However, the measure of the value of many of these changes may lead to debate.

I need not review the personnel or the equipment of a modern clinical laboratory, for this too is common knowledge. Nor do I deem it important in this discussion to evaluate the numerous tests that we look to for assistance, for diagnosis and treatment of our cases.

I shall in great part limit myself to the discussion of the importance of the medical technoligist relative to the work he or she is expected to do.

With our present day set-up we go forth almost blindly, with a thorough confidence in the reports coming from our laboratories because there has been established that *esprit de corps* so necessary for the safety of our patients.

At times when the reports are not in keeping with the history or the physical findings, we ask that the test be repeated, not that we question the sincerity of the worker but because we know that it is human to err, and if an error in technique has occurred the error may be corrected by repeating the test.

No individual laboratory worker is worthy of the name of the confidence of the staff who hasn't a keen conception of the value and paramount importance of one hundred per cent accuracy in all of his reports. He must realize that he is dealing with the most precious thing in the world, human life, and that an error on his part, intentional or otherwise, may lead to the death of a patient. I submit common illustrations. If a mistake be made in blood-typing which results in a transfusion from a noncompatible, or a false blood sugar estimation be reported that is followed by an overdose of insulin, a life may be sacrificed because of the error.

The Essentials of a Medical Technologist

First, I would place honesty of purpose and a character that knows no temptation in the face of accurate laboratory work. Any slip in technique, any questionable result in a laboratory procedure, should call forth the importance of that report and its bearing on the life of that patient. To repeat a test under such conditions is the measure of an honest worker.

Second. Co-operation combined with a spirit of sacrifice is essential. Any technologist should gladly go forth with the clinician, even in the wee small hours, to check on the white blood cells in an acute appendicitis, or the blood chemistry in the face of coma, so that no time be lost in the effort to save the life of the patient.

Third. Every laboratory worker must be a student of those subjects that influence his work and the value and accuracy of his reports. New methods for all of his work should interest him. Advances in the study of pathological physiology and their tests should receive his attention.

Fourth. He should know that the success of any institution prepared to treat the sick, will be enhanced if the laboratory worker understands that he is dealing with *abnormal* people. Courtesy and kindness, diplomacy and tact go far when the sick individual is approached for the purpose of securing a few drops of blood or other material for tests. He must find ways of obtaining what he wants from a small child without causing a riot, and from a finical maiden lady without insulting her dignity.

Fifth. His co-operation with all departments of the hospital lubricates the machinery, reduces lost motion to a minimum, and makes friends for him, of the anaesthetist the X-ray department and the pharmacist and thus promotes a friendly spirit from the manager's office to the sick bed.

Sixth. He will be required to be progressive. Professional standards today demand that he go forward. In his work there is no stationary place. He advances or retrogresses. Therefore, he must be a student of all phases of his work. Advances and refinement in all laboratory methods should interest him. The staff will not only expect but should demand that he be quick to grasp all available information relative to up-to-date ideas in laboratory procedure.

The medical technologist of today is a creature of the medical profession. That profession has been evolved in great part during the past twenty-five years, to meet the insistent demands of the physician for more extensive and complete chemical and microscopical analyses of the various body fluids, secretions, excretions, and tissues.

Refined and highly scientific diagnoses in medical practice today require these things, and no physician in practice can devote the necessary time to accomplish such ends.

Your hours in the laboratory and the conditions surrounding your activities should in great part be satisfactory and will no doubt meet your demands and requirements in proportion to the relative importance of your work.

It is your duty and prerogative to go forward in such a way as to make the results of your work essential and important to medical practice, in and out of the hospital, and make a place for yourself as one of the guardians of the health of our great country.

Prophesy

What of your future?

You are with us to stay and your importance in the economy of treating the sick will increase with the years. If you are to progress or even maintain, you should realize the value of keeping up to date in all lines of your work.

Your successors will be better trained and will doubtless be required to have a far more extensive preparation and serve a longer apprenticeship.

The future will no doubt find the medical technologist the medical student, the future dentist, the nurse, and the anesthetist side by side in the laboratories where all the basic sciences are taught. As each one progresses he will follow the avenue dictated by his desires or possibly as he or she may be regimented, as the years bring some of the undesirable changes we so frequently hear discussed.

Organization

We live in an age where combined effort is essential to our existence. Every avenue of human endeavor has discovered the value of organization. "United we stand, divided we fall," may not apply to your future existence but that the impetus of co-operation will enhance your progress and the value of your services you should all recognize now.

Join your national and local groups, take an active part in its deliberations, promote the interests of those in other groups by joining other organizations for the exchange of ideas. Be prepared to forestall the advances of irregular groups whose methods and ideas are a menace to the best interests of the public.

We have not reached the Utopia of the laboratories, either in personnel or procedure. We feel that due credit should be given those who have been responsible for the advances made, and we stand prepared to co-operate with those who must carry on along the lines that lead to a more ideal situation for the patient and the medical technologist.

A COMPARISON OF THE MEINICKE TEST WITH THE KOLMER AND KAHN IN A SERIES OF 257 TESTS

By ELOISE PATTEN, M.T.

Larned State Hospital, Larned, Kansas

In view of the interest being shown in the newer and quicker tests for the diagnosis of syphilis, this report is submitted for whatever it may be worth. The findings are incidental to my work as technician of the Larned State Hospital (for insane), and are presented with the knowledge and approval of the medical staff.

The test used (in connection with usual Kolmer and Kahn techniques) is the Meinicke clarification test, which may be read either grossly in the test tube, or under the microscope. The test is a simple one, consisting of adding one c. c. of warm antigen (diluted 1 to 10 with 3% physiol. salt solution) to 0.2 c. c. of blood serum, or 0.5 c. c. of the diluted antigen to 0.5 c. c. of spinal fluid. A microscopic reading may be made within 10 minutes, but in most of the tests of this series, the readings were made grossly, after at least 12 hours' standing. Kolmer and Kahn tests were run by the Public Health Laboratory at Topeka on portions of the same specimens which were used for the Meinicke tests.

In the small series on which complete reports are available, the following results were obtained:

Series of 72 spinal fluids and 185 blood serums: total 257 tests.

	Kolmer		Kahn		Meinicke	
	No.	%	No.	%	No.	%
Positive	83	32.2%	64	24.9%	74	28.7%
Negative	165	64.2%	184	71.6%	151	58.7%
Doubtful	5	1.9%	9	3.5%	32	12.4%
Anticomp.	4	1.6%	..	..	..	..

As is shown by the table, a smaller number of negative tests were obtained with the Meinicke, than with either the Kolmer or the Kahn. The comparatively large number of doubtful Meinicke's is due to the fact that a considerable percentage of the specimens were from treated cases of syphilis. It does not compare unfavorably with results obtained by the Johns test as cited by Tate and Robards in the January issue of the "Am. Journal of Med. Technol." An

analysis of the findings, case by case, showed that with the possible exception of five instances, the doubtful Meinicke tests, or those which were positive when the Kolmer and Kahn were negative, were either syphilitics under treatment or patients who showed a history of syphilis previous to admission. It would seem, then, that the test is reliable, and somewhat more sensitive than the usual standard tests. It is easy to perform and easy to read, and deserves consideration as a valuable method for use when time and equipment are not available for more elaborate tests, or as an added procedure to supplement the findings of the Kolmer and Kahn.

THE RELATION OF THE STUDENT TECHNOLOGIST TO THE PATIENT

By OPAL E. HEPLER, Ph.D.*

There are three types of training schools for technicians: (1) the commercial school which is conducted more or less like a laboratory class and demands a large tuition fee for a short course of three or four months' training, (2) the hospital laboratory which takes one or two girls for training, (3) the medical school that has a regular training course.

In the commercial school, the students usually have no contact with patients. They are given specimens either obtained from animals, sent in by physicians, or made up to resemble those characteristic of pathological conditions. The specimen has no individuality as it would have if the student herself had collected it directly from the patient. The analyzing of stomach contents means a great deal more to the student and is far more interesting to her if she helped pump the patient's stomach. Although it is very important to have the student first learn how to make blood counts on oxalated blood and to check a large number of such counts, the student does not learn by this method how to take a count directly from the patient, as it will be necessary for her to do when she becomes a technician in a laboratory. That this condition does actually exist was brought out recently, when a graduate of a well-advertised commercial school came to me for advice. She had failed to make good in a hospital position and had been told that she was too slow and not sure of her work. This was not surprising when she admitted that her training had been limited to examination of specimens obtained from animals. Not once did she work with a patient or with human material. Doing tests on animals at one's leisure is quite different from having doctors rush patients into the laboratory with a demand for an immediate report.

Training received in hospitals is excellent, provided the laboratories are under the direction of a recognized pathologist and employ only well-trained technicians. An advantage of a training in a medical school is the privilege of taking courses in Bacteriology, Biochemistry, and Clinical Pathology under conditions that give the technician a point of view that is more scientific and more practical.

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* Supervisor of student technicians at Northwestern University Medical School.

A brief outline of the course at Northwestern University Medical School may be of help to those interested in training technicians.

The applicants are required to have at least two years of college work, with preference given to those having a degree. This must include two years of college chemistry, one year of biology, and, if possible, courses in parasitology and bacteriology. Eight girls are admitted each year, one every six weeks. In the first six weeks the student technician learns to analyse urines, feces, sputums, and checks 25 complete blood counts on oxalated venous blood. During the second six weeks she does all types of work in hematology, gastric analysis, veno-puncture, renal and liver functions. Thus, after the first six weeks, the student technician works directly with patients. The work of the third six weeks includes bacteriology and Kahns, while that of the fourth six weeks consists of serology, mostly Wassermanns. The girl spends the following three months in the laboratories of Passavant Hospital. This time is divided equally between bacteriology and blood chemistry. On returning to the medical school, she learns how to take Basal rates, electrocardiograms, and assists with blood chemistry for six weeks. One month is spent in the department of Pathology to receive instruction in tissue technic. The last two weeks of the year are spent in general review. At all times the student is under the direct supervision of a well-trained technician. She must first learn how to do the tests by making a certain number of checks; later she is allowed to assist with the routine work. At all times she is considered a part of the working staff, given definite duties, and is impressed with her responsibility.

The most frequent motive that prompts girls to become technicians is the enjoyment obtained from their science courses in college. They have no definite idea what a technician's work consists of; they picture a laboratory with fancy glassware, complicated apparatus, and solutions of many colors. They do not realize that the first step necessary for a great many tests is to obtain the material directly from the patient. Perhaps it is just as well they do not know how disagreeable it is to pump the stomach of some people, or to bleed a screaming child with the parents taking the attitude that you are deliberately hurting their darling pet. There are a few research jobs where rats, mice, guinea pigs and other animals act as subjects. Research positions in which rats, mice, guinea pigs and other animals serve as patients are few in number. Girls entering clinical laboratory work should, therefore, know that there is a great deal more to such work than merely performing tests with simple or complicated apparatus.

Because of the constant contact with patients, a very important

part of any technician's training is to become experienced in handling people. This can only be acquired in a laboratory where a large amount of work is done on patients. A few suggestions might help the student in her contact with patients. The greatest value, however, is obtained by careful observation of trained workers and their kindly criticism of the student's first attempts.

First of all, the technician must know how to gain the confidence of the patient. This is the first principle taught to medical students in their clinical years, and should be the first taught to technicians when they begin working with patients. In order to gain the patient's confidence, the technician must have confidence in herself. There are three ways to acquire this self-confidence. First, she must understand the underlying principles of every step of each procedure, so if any deviation from the usual routine is necessary, she will be able to vary the technique to meet the demand. Not only is it necessary to be familiar with all the equipment to be used, but also to see that it is in good condition, arranged systematically, and as inconspicuous as possible on her tray. Second, self-confidence can be gained only by practice. This is only possible where there are a great many patients and a large volume of work. Third, the student technician should be given definite responsibilities in the laboratory beginning with her first day. These tasks should be gradually increased throughout her training until, at the end, she is capable of taking complete responsibility of any part of the work. Along with taking responsibility, she learns how to do work in a systematic manner. Later, this will be a great advantage when she is organizing her own work in a new position. At all times the student should be considered a part of the working staff. This not only makes the work more interesting, but gives her confidence in herself and a sense of her own responsibility to the laboratory, the patients, and the physicians.

The ability of the technician to judge quickly different types of people is a great advantage in winning the confidence of a patient. Sick people, as well as normal people, react quite differently to various kinds of treatment. Sometimes it takes a great deal of ingenuity and tact to persuade the patient to let the technician proceed with the test. Therefore, patients should be treated as individuals, some needing firmness, others persuasiveness. Sick people are apt to be very nervous and must be handled gently and with great patience. Some situations are very trying to the technician's nerves and good nature, and are impossible to handle unless she has not only had experience in handling patients, but also in performing the test. One trying situation is to know how to take blood from

an hysterical woman, especially if she is obese and has small veins. It often takes a great deal of persuasion before she will consent to being punctured. Then it is necessary to work quickly and smoothly, for if one misses the first time, it is not very likely with such a patient that it will be possible to make a second attempt. Children are often difficult to handle and parents, as a rule, are a greater hindrance than help. Usually one has a scared child and a parent that is still more scared. One can gain a child's confidence much more easily alone.

Unless a girl really enjoys working with all types of people, she should not be encouraged to take positions which require this kind of work. Technicians can usually be classed into two very definite types, those who enjoy their work because of contact with patients, and those who much prefer only the technical side.

While the technician is winning the confidence of the patient, she must give him an assurance of her ability. She must go about her work with a professional attitude, avoid the appearance of hurrying, and leave an impression of thoroughness and accuracy. A hurried manner only confuses and excites the patient. The patient should be kept as comfortable as possible during the procedure. Results of careless work may be very harmful. A hematoma in the arm may not only cause pain, but lead to the patient's changing doctors. This ability to gain the patient's confidence can only be acquired by proper training in which the student actually takes a large number of blood counts, pumps stomachs, and draws venous blood under the directions of a well-trained technician, who already has the confidence of the patient. With this ability, the technician will be able to handle her patients in her first position without fear of complaints to her superior. This is one of the greatest advantages in a training course where the students learn to be technicians by actual experience, instead of running through a large number of tests taught like a chemistry course in school. All schools for technicians should have facilities for the student to come in contact with patients.

Beside knowing how to handle patients with tact as well as skill, a technician should be able to think quickly and be capable of meeting emergencies without becoming confused. All work with patients, no matter how simple, has an element of potential danger. Patients often faint at the most unexpected moment, and an injury may result. A frequent test in any laboratory is the administration of histamine for a gastric analysis, and this is not without danger. As simple a thing as passing a stomach tube may lead to serious consequences. Sudden death has occurred by this procedure in a

patient with angina pectoris. The technician was not to blame, but this demonstrates that she must be alert to all kinds of reactions in patients, must be able to meet them by her own ingenuity, alone if necessary, but must never hesitate to call for help when it is needed and available.

We must not go so far as to say that the technician's contact with the patient is the most important part of her work. A patient's future treatment or welfare may depend entirely on the technician's report. A whole family may be quarantined for weeks because of a diphtheria culture which is wrongly diagnosed positive. A positive report for tuberculosis may be given when what was thought to be tubercle bacilli were only stained scratches in the slide. In the last few years, we have not only heard a great deal about amebiasis, but also have learned a great deal. Many technicians who are looking for amoebae have never seen one. Others do not know the fine points of distinction between histolytica and coli. There was one technician who actually had the differential points between coli and histolytica reversed; patients with coli were receiving the very toxic treatment for amoebic dysentery. A diagnosis for appendicitis or kidney stone may depend a great deal on the technician's blood count and urinalysis report. Death may result from a blood transfusion as a result of a mistake in typing. All of these indicate the necessity of accurate work on the part of the technician, whether she is occupying her first position or has had years of experience.

To summarize: The different types of training schools available have been pointed out, and the necessity of actual contact with patients and the placing of definite responsibility on the student technician throughout her course of training have been emphasized. It is only by such training that she can acquire the ability to gain the confidence of patients, to meet emergencies as they arise, and to trust her own proficiency and competence. The student technician should, therefore, select her place of training with care.

THE FUNCTION OF THE CLINICAL LABORATORY

In selecting "The Function of The Clinical Laboratory" as a subject upon which to speak to a group of trained laboratory workers such as this, it may at first glance appear that my choice has been somewhat obvious and, perhaps, not altogether appropriate.

It is, however, not always unprofitable in any field of endeavor —and particularly, it seems to me when it is of a specialized character—to consider from time to time just what is its purpose, and why it exists, and in thus striking a trial balance, as it were, to consider what we are accomplishing in a chosen field and whether or not, through unconscious errors of omission or commission we are falling short of the goal we may have set for ourselves.

I feel rather confident that if the question "What is the function of the clinical laboratory?" were generally propounded that many— and, oddly and unfortunately, not a few of them physicians and even laboratory workers—would reply: "Why, to make tests."

It is, of course, true that many of the laboratory procedures with which we are all familiar may in a sense be described as tests for the presence or absence of specific substances. Somewhat insidiously there has been derived from this concept the further concept that tests for the presence or absence of specific substances connote tests for the presence or absence of specific diseases. This, of course, is an unwarranted, erroneous, and even absurd conception as even a moment of thoughtful consideration suffices to demonstrate, and, as laboratory workers, it is our plain duty and to our interest to see to it that such a concept be opposed and corrected.

To this end we must be able to define the function of the clinical laboratory clearly, succinctly, and definitely, not only to others but to ourselves.

Let us ask ourselves, then, the specific question, "What *is* the function of the clinical laboratory?" and see if we may answer it intelligently.

EDITOR'S NOTE—*This article was read by Dr. Robert A. Kildufje to those assembled during the annual convention of the American Society of Medical Technologists, held in Atlantic City, June 7-9, 1937.*

As part of the physician's armamentarium the primary purpose of the clinical laboratory is to aid and contribute to the recognition, management, and control of disease.

Health, it seems to me, may be somewhat generally but comprehensively, defined as a state of functional efficiency. Disease, likewise, may be regarded as the result of disturbance, alteration,, or loss of functional efficiency. The healthy individual is one whose bodily mechanisms—numberless, complex, interlocking and interdependent though they be—are functioning efficiently, quietly, and without friction. When friction occurs, efficiency is impaired, disturbance becomes manifest and more or less obvious, the malfunction thus evidenced constituting the manifestations of the underlying, not always obvious cause—or, in brief, the symptoms of disease.

The physician confronted with such manifestations is likewise immediately confronted with the obvious necessity of determining their cause. In other words, before intelligent measures for the treatment of disease are possible, its nature and mechanism must first be determined. There must be in brief, a proper and accurate diagnosis before treatment can be intelligently or properly planned or conceived.

These basic principles are, of course, obvious but their application and utilization are seldom as simply defined. For while the evidences of disease may be both marked and well defined, the underlying cause may be far from as easily determined.

Diagnosis is the sum total of all the observations made in the particular case. It seldom depends upon single, isolated factors; more often upon a keen and critical summation and analysis of varied factors and varied information gathered and determined in a variety of ways, not the least important of which are the procedures of the clinical laboratory.

The function of the clinical laboratory, I believe, may be succinctly stated as being primarily a specialized phase of the examination of the patent, in some cases of paramount and in others of ancillary importance, but always of significance when intelligently applied and equally intelligently interpreted.

It is possible, without delving too deeply into the realm of fancy, to take advantage of the present vogue in mystery fiction and draw upon the devices of the detective story writer for analogy in the development of this concept. We may, for example, regard disease as the criminal to be caught and controlled. The physician, then,

may be looked upon as the detective inspector confronted with the accomplished crime—the patient in whose body function has been mangled, slain, or stolen, and upon his keenness of observation, astuteness and acumen in inferential deduction the detection and apprehension of the criminal will depend.

As all detective story readers well know, with the appearance of the inspector upon the scene a well organized mechanism begins to get under way. There will be, first of all, a careful and meticulous survey of the situation as a whole—in other words, in our analogy, a careful and meticulous observation of the presenting condition of the patient.

Just as certain types of crime in a more or less definite way suggest certain specific types of criminal, so certain more or less characteristic signs and symptoms in a more or less definite way may suggest more or less specific diagnostic possibilities. And just as the detective inspector will then set in motion a systematic dragnet covering the more likely haunts of his prey, so will the physician cast his dragnet—his examinations—to cover the most likely foci where his criminal—the disease—may most logically be expected to be lurking.

Every now and again, however, these obvious suggestions are missing and the investigation perforce must be extended to cover not only probable but even at first glance improbable factors.

Witnesses must be rounded up and questioned—(the history of the onset—the present and past medical history)—clues must be looked for, gathered, and their value and possible significance weighed—(the physical examination)—all the findings of even nebulous or problematical value must be weighed in the balance.

It may not always be evident immediately whether or not a specific fact is a real clue or merely of incidental or coincidental significance; its very existence and presence may be revealed only be specialized and expert examination. And so there enter the various specialized investigators: the Home Office experts of varied type from Scotland Yard.

In like manner, despite the care and skill with which the physician takes his history and makes his examination, there may be findings whose significance is doubtful, there may be facts whose existence can be surmised—but whose presence must be verified and weighed in the balance of expert and specialized examination.

And so the laboratory may be regarded as the doctor's Scotland Yard, as it were, in which evidences of disease are sought for and

measured by specialized laboratory procedures. While thus constituting only a phase in the examination, the laboratory is always an important avenue of approach to the recognition and study of disease; and, sometimes, an approach of paramount value.

We who work in laboratories may sometimes feel that, perhaps, we are in danger of falling into a rut, that the days may become a monotonous repetition of one blood count after another, of innumerable urinalyses, of an interminable procession of chemical determinations.

This, however, is more apparent than real. We must never lose sight of the fact that upon the results of our findings grave and even momentous decisions may be based. Upon our care in gathering information, upon our honesty in reducing it to statements of fact the correctness of diagnosis and the efficiency of treatment may stand or fall.

We can never do just another blood count. Whether we appreciate it or not—and we must always appreciate it—we are preparing for the scrutiny and evaluation of the physician information of far-reaching value and significance to some specific individual.

We cannot all be inspectors—just as there can be no army composed entirely of generals. The inspector must have his finger-print men, his photographers, his details who go out on special, specific, and sometimes on the face of it, apparently hum-drum and uninteresting, merely laborious duties. Very often they may remain ignorant of the final outcome, uninformed as to the value of their work and the degree to which they may have contributed to the final denoument.

So, too, the physician, and the pathologist must have you—the technician—whose duty it is to gather and prepare for *their* scrutiny and interpretation facts and factors which may or may not be of ultimate and definitive value in the specific case.

You are not merely making tests. You are playing an important, if not always prominent, part in the study of disease. If, for obvious and apparent reasons, you are not called upon to apply the results of your work to the particular problem at hand, if, in other words, the clinical interpretation and utilization of laboratory procedures includes, as it does, fields in which you have not been trained, matters not included in your general background; though this responsibility is not yours, you are nevertheless not devoid of responsibility. Far from it!

Yours is the responsibility of furnishing to the physician and

the pathologist the accurate information upon which the destiny of the patient not infrequently depends.

Upon your integrity, your conscientious and honest application of that which you have been taught; upon your consistent endeavor to digest and benefit by the experience vouchsafed to you; upon all these may rest the fate of the patient in whose interest your work is carried on.

You are thus far more than merely makers of tests, as you may well impress upon the unthinking and the misinformed as opportunity presents.

And, most important of all, yours is the opportunity to assist in no small measure in upholding and maintaining the true function of the clinical laboratory.

ABSTRACTS

A NEW METHOD OF DIFFERENTIATING BIOCHEMICALLY THE COLI AND AEROGENES GROUPS OF BACTERIA. C. Barthel, Lantbruks-Hogskolans Annaler, 3, 179-89 (1936).

A method based on the fixation of iodine is presented.

THE ELICITATION OF SPECIFIC PHAGE FROM AUTOCLAVED (LIFELESS) MATERIAL. STUDIES IN BACTERIAL METABOLISM: Arthur I. Kendall, Jour. Inf. Dis., 59, 340-8 (1936).

Effective phage was obtained from material that had been autoclaved and from the same material that was not heated, but filtered. The author concludes that phage is not a living ultramicrobe or a so-called living virus.

THE EFFECT OF ANTICOAGULANTS ON BLOOD LIPIDES: Eldon M. Boyd and R. B. Murray, Jour. Biol. Chem. 117, 629-38, 1937.

The effect of various anticoagulants on cell volume and the consequent concentration of lipide in the cells and in the plasma is discussed.

SURVIVAL OF OXYGEN AND WATER DEPRIVAL BY TUBERCLE BACILLI: Truman Squire Potter, J. Inf. Dis., 60, 88-93, 1937.

Keeping the organisms as free from water and oxygen as possible permitted the survival of avian tubercle bacilli for a year at body temperature and around 2 yrs. at room temperature.

QUANTITATIVE ISOLATION OF ETHYL ALCOHOL FROM TISSUES OF ALCOHOLICS: Alexander O. Gettler and Henry Siegel. Amer. Jour. Clin. Path., 7, 85-93, 1937.

The alcohol is isolated and its volume determined. It is identified by determining the physical constants and molecular weight, and some chemical properties by micro methods.

INFLUENCE OF TEMPERATURE ON GROWTH AND TOXIN PRODUCTION BY CLOSTRIDIUM BOTULINUM: F. W. Tanner and E. E. Oglesby. Food Research, 1, 481-94, 1936.

Comparison of temperature requirements of detoxified spores and growing cells is given. The authors conclude that food stored at low temperatures is much safer in respect to this organism than when stored at ordinary temperatures.

ESSENTIAL IMMUNIZING ANTIGEN OF THE TYPHOID BACILLUS: Lloyd D. Felton and Frank B. Wakeman. Bull. Johns Hopkins Hospital, Vol. LX, No. 3, March, 1937, p. 178.

The authors isolated the polysaccharide fraction of the typhoid bacillus and found it produced a greater immunity than the total weight of the acetone extracted dried typhoid bacilli from which it is derived.

THE IRON-DEFICIENCY ANAEMIA OF LATE INFANCY: Harold H. Fullerton, Arch. of Dis. Childhood, Vol. 12, No. 68, p. 91.

Subnormal haemoglobin levels of late infancy were found to be due to iron deficiency resulting largely from low birth weight, artificial feeding and infective illnesses.

THE BONE MARROW IN THE MONKEY (MACACUS RHESUS): Joseph Starney and George M. Higgins, Anat. Rec., Jan. 25, 1937, Vol. 67, No. 2, p. 219.

The author discusses the similarity of the distribution of the various cells in the bone marrow. Myeloid activity is greater than erythroid in the rib, sternum, vertebra and femur, but, erythroid cells exceed myeloid in the tibia.

HISTOLOGICAL STUDY OF RENAL ELIMINATION OF ASCORBIC ACID: A. Giroud and C. P. Leblond, Anat. Rec., Vol. 68, No. 1, April 25, 1937, p. 113.

A histological method, checked by titration, was used to study renal elimination of ascorbic acid (Vitamin C.)

Animals fed diets without ascorbic acid showed a progressive decrease and disappearance of it in the kidney tissue in animals unable to synthesize it, but not in those able to synthesize it. After intravenous injection of ascorbic acid the amount in the kidney tissue rose to over ten times normal while that of other tissues was about 2-3½ times normal. The values for the urine rose to over one hundred times normal.

BOOK REVIEWS

MANUAL OF PUBLIC HEALTH LABORATORY PRACTICE, by J. R. Currie, Henry Mechan, Professor of Public Health, University of Glasgow, and Contributors. William Wood & Co., Publishers, Baltimore, Md., 1936. Pp. 378 and 169 illustrations. Cloth. Price $6.75.

This book is intended primarily for medical graduates and students of public health. The sections dealing with the various phases of Public Health are divided as follows: chemistry, bacteriology, protozoology, helminthology, entomology and meteorology. In the section on chemistry the author has included the essential chemical processes for the examination of water and various food stuffs, but has purposely omitted extensive and detailed analytical methods as these do not fit in with the intent or scope of the book. The section on bacteriology takes up air, soil, water, sewage effluents, various foods, etc., as well as the bacteriological diagnosis of the specific infections. The section on protozoology by A. G. Mearus, B.Sc., M.D., D.P.H., Lecturer in Public Health, University of Glasgow, has been dealt with in greater detail. Likewise the sections on helminthology by Margaret W. Jepps, M.A. Cantab., and entomology by Robert A. Staig, M.A., Ph.D., F.R.S.E., Lecturers in Zoology, University of Glasgow, are entirely adequate for public health work and include the food-stuff moths, food-destroying beetles, clothes moths and furniture beetles which have an economic interest. The sections are well illustrated with drawings by the authors. The section on meteorology includes information on atmosphere, insulation, temperature, barometric pressure, wind, humidity and weather maps.

MEMORANDA OF TOXICOLOGY, by Max Trumper, B.S., A.M., Ph.D., Consulting Clinical Chemist and Toxicologist. Member, United States Advisory Board on Hazardous Occupations for Minors. Formerly Lecturer on Toxicology, Jefferson Medical College, Philadelphia, Penna. P. Blakiston's Son & Co., Inc., 1012 Walnut St., Philadelphia, Penna. Third Edition, 1937. Flexible washable binding, 304 pp. Price $2.00.

To write any sort of work on toxicology at once presents many difficulties. No one work is complete on the subject because of the innumerable new substances that have been introduced in industry and in medicine. The current medical and chemical literature does not contain records of poisoning by all substances capable of caus-

ing poisoning. This leads to the chapter entitled "What is a poison?" by Dr. Henry Leffmann who states, "A great many answers, verbal and written, have been given, but none has yet been offered which will stand skillful cross-examination."

This pocket-sized third edition has been enlarged by nearly 100 pages. Part I deals with general toxicology and corrosives; part II with simple irritants; III, specific irritant poisons; IV, neurotic poisons. Part IV is divided into chapters on narcotics, anaesthetics, inebriants, deliriants, convulsants, paralysants, hyposthenisants or syncopants, depressants, asphyxiants and abortives. The appendix deals with bites of venomous reptiles, rabid animals and insects and other newer substances including dimitrophenol, thallium, insulin, etc. There is a chapter by Dr. S. T. Gordy on the neuropsychiatric aspects of intoxications by lipoid solvents.

The author has packed a wealth of practical toxicology into this small volume as well as new views on antidotes and methods of treatment resulting from extensive studies in toxicology, physiology, clinical chemistry and observations for more than eighteen years in medical clinics and hospitals. Industrial first aid departments, chemical and clinical laboratories as well as physicians will find the book quite valuable.

NEWS AND ANNOUNCEMENTS

REGISTRY OF MEDICAL TECHNOLOGISTS
OF THE
AMERICAN SOCIETY OF CLINICAL PATHOLOGISTS

The Board of Registry met in Philadelphia and adopted a number of new regulations. In future examination of applicants for registration the psychological factor will hereafter be disregarded and ratings made solely on the practical and written examinations, each of which is to be of equal weight in the rating.

The annual report of the Registry showed a successful year in the acquisition of new registrants. From the report given by the Chairman of the Board to the American Society of Clinical Pathologists we cull the following data:

Examinations held in

	April, 1936	October, 1936
Number of applicants	320	420
Number passed	283	355
Number of examiners	94	111

The work of the Registry was highly praised both by clinical pathologists as well as the Medical Technologists. The former particularly remarked on the higher intellectual status and efficiency of the laboratory personnel since the inauguration of the Registry which has led to the elimination of the unfit and an actual dearth of and greater demand for registered Medical Technologists. The employment agencies also report an increased demand for certificate holders.

The Registry would like to spread the news that, in accordance with the regulations laid down in our booklet, there will be higher pre-training requirements on and after January 1, 1938, including two years of college work with emphasis on chemistry, physics, bacteriology and biology.

NATIONAL

During the sessions of the American Society of Medical Technologists held in Atlantic City, N. J., June 7-9, the Committee on Awards composed of Dr. J. J. Moore, Chairman, Chicago, Ill., Dr. Asher Yaguda, Newark, N. J., Dr. LeRoy Kracke, Emory, Ga., and Frieda Ward, Newark, N. J., granted to Dorothy Morris of Newport News, Va., for her paper on "Discussion of Allergy Technique," and the drawings of pollens which accompanied her paper, the silver medal of the Society which was the highest award.

The second award bronze medal went to F. B. Donovan, M.T., and C. E. Bramble, Ph.D., Mercy Hospital, Baltimore, Maryland, for their exhibit of Three Color Separation Photography.

In addition to these awards two Honorable Mention Certificates were granted:

To Ann Snow, University of Arkansas, Little Rock, Arkansas, for her paper, "Some Laboratory Findings in Sickle Cell Anemia."

To Phyllis Stanley, M.T., Presbyterian Hospital, Newark, N. J., for her exhibit on Examples of Photography.

Copies of the minutes and proceedings of the 1937 sessions of the American Society of Medical Technologists will be mailed to all active members.

The Administrative Office has been authorized to issue new certificates of membership. These will be mailed with membership cards upon receipt of 1937-38 dues.

STATE

Arkansas

The Arkansas Society met on May 18, 1937, and elected the following officers: President, Juanita Straubie; Vice-President, Florence Templeton; Secretary, Cleo Fulmer; Treasurer, Beth Galbraith; Executive Committee: Ann Snow, Amelia Metrailer, and Margaret Becker.

After the election Dr. Maude Syle, guest speaker, presented a paper outlining her research work on cancer.

Minnesota

With the election of Chauncey H. Winbigler, of St. Joseph's Hospital, St. Paul, as President, and Edith Damgaard, of the Duluth Clinic, Duluth, as Secretary-Treasurer, the temporary organization of a new state society was accomplished Friday, May 14, 1937, in

OFFICERS A. S. M. T.

1937-38

President, FRIEDA WARD, M.T.

—

President-Elect, CHRISTINE SEGUIN, M.T.

—

Vice-President, ANN SNOW, M.T.

—

Secretary, MARION GIANNINY, M.T.

—

Treasurer, HERMINE TATE, M.T.

Plummer Hall of the Mayo Clinic, Rochester, Minnesota. This society is the Minnesota Society of Medical Technologists. Its present membership is slightly over three hundred individuals who work at one phase or another of medical technology.

The stimuli that gave rise to this organization was the invitation on the part of the Minnesota Hospital Association to have medical technologists convene with the hospital association as an allied organization, and a resolution on the part of the American Society of Medical Technologists to charter each state in the union this year. With the Minnesota Hospital Association convention at Rochester, May 13, 14 and 15, came the opportunity to invite all medical technologists to Rochester for the purpose of organizing and of participating in the three day convention.

Outstanding features of the Medical Technologists' program in Rochester was the sectional luncheon in the sun room, eleventh floor of the Kahler Hotel, at which one hundred participated. Notable among the guests were: Dr. W. A. O'Brien, Associate Professor Pathology of the University of Minnesota; Dr. Kano Ikeda, Secretary of the Board of Registry for Medical Technologists of the American Society of Clinical Pathologists; Dr. Arthur H. Sanford, Chairman of Clinical Laboratories Committee, Mayo Clinic; Dr. Walter Boothby, Director of the Department of Metabolism of Mayo Clinic; Dr. A. E. Osterberg, Director of the Chemical Laboratories of the Mayo Clinic; Dr. N. H. Lufkin, Pathologist of Minneapolis General Hospital, and Dr. Kvitrud, Pathologist of the Midway Hospital, St. Paul.

The short business session following the scientific program resulted in the creation of this new state organization, which though somewhat temporary in nature has gone on record as defining membership within it as being synonymous with registration with the Board of Registry for Medical Technologists of the American Society of Clinical Pathologists. This was quite a happy issue because of the small percentage of members now registered as compared with the roster which numbers over three hundred.

The universally conceded fact is that Minnesota has now the nucleus of a very promising state organization and that a marvelous unity was established at the Rochester convention between the various factions that formerly represented Medical Technology in Minnesota.

Missouri

The annual meeting of the Missouri Society of Medical Technologists was held May 8th, at St. Mary's Hospital, Jefferson City, Missouri. The following program was presented:

9:30 A. M.—Registration.

10:00 A. M.—Invocation, Rt. Rev. Joseph Selinger, S.T.D., Jefferson City, Mo. Address of Welcome, Dr. Thomas J. Kelly, Jefferson City, Mo. Business Session.

12:00 Noon—Luncheon.

1:30 P. M.—Relation of Saline Fragility Test to Size and Shape of Red Corpuscles, Dr. G. O. Broun, St. Louis University, St. Louis, Mo.

2:00 P. M.—Bile Chemistry, Mrs. Marie Carr, M.T., St. Margaret's Hospital, Kansas City, Kansas.

2:30 P. M.—The Serological Diagnosis of Infectious Mononucleosis, Dr. Arie van Ravenswaay, Van Ravenswaay Clinic, Boonville, Mo.

3:15 P. M.—Technicians' Tips, Dr. John R. Roberts, St. Louis University, St. Louis, Mo.

3:45 P. M.—Laboratory Diagnosis of Undulant Fever, Dr. Ralph Emerson Duncan, Duncan Laboratories, Kansas City, Mo.

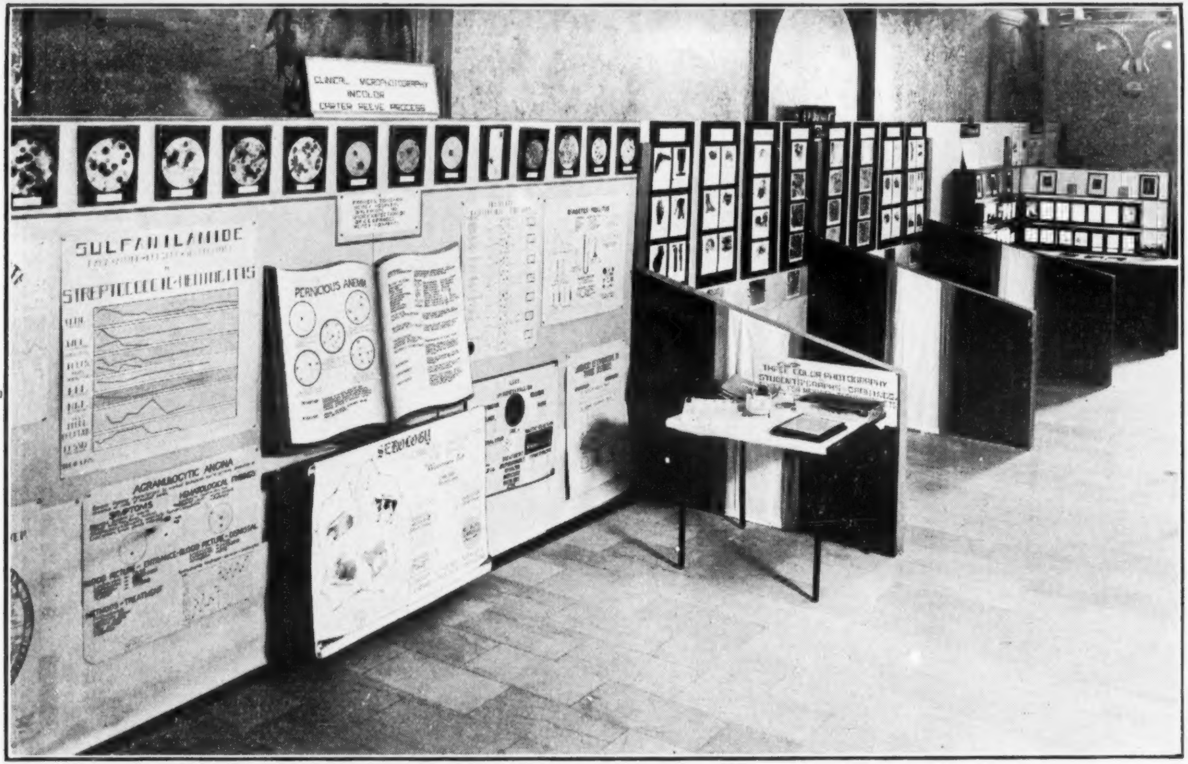
4:15 P. M.—Election of Officers. Trip to Missouri State Capitol. Entertainment by St. Peter's School of Music.

After the program a meeting was called by the president, Sister Mary Bernard, and the following officers were elected for the ensuing year: President, Sister Mary Bernard Hainen, Boonville; Vice-President, Mrs. Olive Stone, Springfield; Secretary, Sister Mary Irmena Olds, Kansas City; Treasurer, Miss Alice M. Bardwell, Springfield; Executive Committee, Miss Augusta Schwein, Booneville.

The Society was invited to hold its next meeting at University Hospital, Columbia, and Mercy Hospital, Springfield. Springfield was selected, the date of the meeting will be announced later.

Oklahoma

The Oklahoma Society of Medical Technologists held their first annual banquet April 24 in Oklahoma City. Dr. Phillip Hillkowitz, chairman of the Board of Registry of the American Society of Clinical Pathologists, was the guest speaker of the evening. Miss Ida Lucille Brown, state president, presided and gave the address of welcome. Dr. Hugh Jeter acted as toastmaster. Dr. Ivo Nelson of Tulsa also gave a short address. All of the clinical pathologists of the state were present as well as many practicing physicians. An additional guest of honor was Miss Marion Baker, president-elect of the Texas State Society.



Sectional View of Scientific Exhibits. A. S. M. T. Convention, Atlantic City. N. J., June 7-9, 1937